

**AMIETE – ET (NEW SCHEME)**

Time: 3 Hours

**JUNE 2012**

Max. Marks: 100

*PLEASE WRITE YOUR ROLL NO. AT THE SPACE PROVIDED ON EACH PAGE IMMEDIATELY AFTER RECEIVING THE QUESTION PAPER.*

**NOTE:** There are 9 Questions in all.

- Question 1 is compulsory and carries 20 marks. Answer to Q.1 must be written in the space provided for it in the answer book supplied and nowhere else.
- The answer sheet for the Q.1 will be collected by the invigilator after 45 minutes of the commencement of the examination.
- Out of the remaining EIGHT Questions answer any FIVE Questions. Each question carries 16 marks.
- Any required data not explicitly given, may be suitably assumed and stated.

**Q.1 Choose the correct or the best alternative in the following: (2×10)**

a. If the radius of an atom in a simple cubic crystal is  $r$ , the body diagonal of the unit cell is

- |                           |                    |
|---------------------------|--------------------|
| (A) $r\sqrt{3}$           | (B) $2r\sqrt{3}$   |
| (C) $\frac{4r}{\sqrt{3}}$ | (D) $\frac{3r}{4}$ |

b. The Burgers vector of a dislocation in NaCl is

- |                   |                   |
|-------------------|-------------------|
| (A) $5.58A^\circ$ | (B) $4.83A^\circ$ |
| (C) $3.95A^\circ$ | (D) $2.79A^\circ$ |

c. The fastest diffusing species in Fe is

- |       |        |
|-------|--------|
| (A) H | (B) Ni |
| (C) C | (D) W  |

d. The Fermi level  $E_F$  depends on the length  $L$  of a linear solid as

- |                     |                        |
|---------------------|------------------------|
| (A) $\frac{1}{L^2}$ | (B) $\frac{1}{L^3}$    |
| (C) $\frac{1}{L}$   | (D) independent of $L$ |

e. The majority charge carriers in P type Ge are

- |                    |                          |
|--------------------|--------------------------|
| (A) free electrons | (B) ions                 |
| (C) holes          | (D) conduction electrons |

Code: AE58

Subject: MATERIALS &amp; PROCESSES

- f. The factors that obstruct domain wall motion in Fe are
- (A) voids (B) impurity atoms  
(C) dislocations (D) all of above
- g. During melting, the relative dielectric constant
- (A) always increases (B) always decreases  
(C) may increase or decrease (D) none of above
- h. The temperature coefficient of resistance for thermistors is
- (A) positive (B) negative  
(C) both (A) & (B) (D) none of above
- i. Mica is used in capacitors which have capacitance in range of
- (A) pF (B) nF  
(C)  $\mu$ F (D) mF
- j. JFET is
- (A) voltage controlled voltage source  
(B) voltage controlled current source  
(C) current controlled voltage source  
(D) current controlled current source

---

**Answer any FIVE Questions out of EIGHT Questions.  
Each question carries 16 marks.**

---

- Q.2** a. State and illustrate Bragg law of X-ray diffraction, also write its applications. (8)
- b. Define bond energy and bond length. What is the relation between atomic size and the bond length? Discuss effect of temperature on the mean spacing between atoms forming a chemical bond. (8)
- Q.3** a. Compare crystalline and non crystalline states. Discuss bonding in graphite and diamond. (8)
- b. The surface of a copper crystal is of the [111] type. Calculate the surface energy of copper. (8)
- Q.4** a. Explain the Kirkendall effect and diffusion process in ionic crystals. (8)
- b. Explain the following:
- (i) Contact potential
- (ii) Effect of temperature on conductivity of metals. (4+4)

- Q.5** a. What is polarisation? Discuss various polarisation mechanisms. (8)
- b. Define the following:  
(i) Ferroelectricity  
(ii) Piezoelectricity  
(iii) Dielectric losses  
(iv) Loss tangent. (8)
- Q.6** a. In a 440V, 50Hz transformer, the total iron loss is 2300 W. When the applied voltage is 220V, 25Hz the iron loss is 750W. Calculate hysteresis loss at the rated voltage & frequency. (8)
- b. Classify the magnetic materials based on alignment of domains in magnetic field and discuss origin of permanent magnetic dipoles. (8)
- Q.7** a. Differentiate intrinsic and extrinsic semiconductors. Compare P-type & N-type semiconductors. (8)
- b. As the concentration of electrons in a semiconductor is changed by changing the impurity level, the conductivity also changes. Show that it passes through a minimum when  $\eta_e = \eta_i \sqrt{\frac{\mu_h}{\mu_e}}$  and find the minimum value. Here  $n_i$  is the intrinsic concentration. (8)
- Q.8** a. Discuss properties and applications of semiconducting materials. (8)
- b. Write applications of the following:-  
(i) NTC Thermistors  
(ii) Variable resistors  
(iii) Electrolytic capacitors  
(iv) Reed Relay (4+4)
- Q.9** a. Discuss various steps involved in fabrication of junction transistors. (8)
- b. Explain construction and working of JFET. Draw its V-I characteristics. (8)